caudal regression syndrome

Caudal regression syndrome is a disorder that impairs the development of the lower (caudal) half of the body. Affected areas can include the lower back and limbs, the genitourinary tract, and the gastrointestinal tract.

In this disorder, the bones of the lower spine (vertebrae) are frequently misshapen or missing, and the corresponding sections of the spinal cord are also irregular or missing. Affected individuals may have incomplete closure of the vertebrae around the spinal cord, a fluid-filled sac on the back covered by skin that may or may not contain part of the spinal cord, or tufts of hair at the base of the spine. People with caudal regression syndrome can also have an abnormal side-to-side curvature of the spine (scoliosis). The spinal abnormalities may affect the size and shape of the chest, leading to breathing problems in some individuals.

Individuals with caudal regression syndrome may have small hip bones with a limited range of motion. The buttocks tend to be flat and dimpled. The bones of the legs are typically underdeveloped, most frequently the upper leg bones (femurs). In some individuals, the legs are bent with the knees pointing out to the side and the feet tucked underneath the hips (sometimes called a frog leg-like position). Affected individuals may be born with inward- and upward-turning feet (clubfeet), or the feet may be outward- and upward-turning (calcaneovalgus). Some people experience decreased sensation in their lower limbs.

Abnormalities in the genitourinary tract in caudal regression syndrome are extremely varied. Often the kidneys are malformed; defects include a missing kidney (unilateral renal agenesis), kidneys that are fused together (horseshoe kidney), or duplication of the tubes that carry urine from each kidney to the bladder (ureteral duplication). These kidney abnormalities can lead to frequent urinary tract infections and progressive kidney failure. Additionally, affected individuals may have protrusion of the bladder through an opening in the abdominal wall (bladder exstrophy). Damage to the nerves that control bladder function, a condition called neurogenic bladder, causes affected individuals to have progressive difficulty controlling the flow of urine. Genital abnormalities in males can include the urethra opening on the underside of the penis (hypospadia) or undescended testes (cryptorchidism). Females may have an abnormal connection between the rectum and vagina (rectovaginal fistula). In severe cases, both males and females have a lack of development of the genitalia (genital agenesis).

People with caudal regression syndrome may have abnormal twisting (malrotation) of the large intestine, an obstruction of the anal opening (imperforate anus), soft out-pouchings in the lower abdomen (inguinal hernias), or other malformations of the

gastrointestinal tract. Affected individuals are often constipated and may experience loss of control of bladder and bowel function.

Frequency

Caudal regression syndrome is estimated to occur in 1 to 2.5 per 100,000 newborns. This condition is much more common in infants born to mothers with diabetes when it affects an estimated 1 in 350 newborns.

Genetic Changes

Caudal regression syndrome is a complex condition that may have different causes in different people. The condition is likely caused by the interaction of multiple genetic and environmental factors. One risk factor for the development of caudal regression syndrome is the presence of diabetes in the mother. It is thought that increased blood sugar levels and other metabolic problems related to diabetes may have a harmful effect on a developing fetus, increasing the likelihood of developing caudal regression syndrome. The risks to the fetus are further increased if the mother's diabetes is poorly managed. Caudal regression syndrome also occurs in infants of non-diabetic mothers, so researchers are trying to identify other factors that contribute to the development of this complex disorder.

Some researchers believe that a disruption of fetal development around day 28 of pregnancy causes caudal regression syndrome. The developmental problem is thought to affect the middle layer of embryonic tissue known as the mesoderm. Disruption of normal mesoderm development impairs normal formation of parts of the skeleton, gastrointestinal system, and genitourinary system.

Other researchers think that caudal regression syndrome results from the presence of an abnormal artery in the abdomen, which diverts blood flow away from the lower areas of the developing fetus. Decreased blood flow to these areas is thought to interfere with their development and result in the signs and symptoms of caudal regression syndrome.

Some scientists believe that the abnormal development of the mesoderm causes the reduction of blood flow, while other scientists believe that the reduction in blood flow causes the abnormal mesoderm development. Many scientists think that the cause of caudal regression syndrome is a combination of abnormal mesoderm development and decreased blood flow to the caudal areas of the fetus.

Inheritance Pattern

Caudal regression syndrome occurs sporadically, which means it occurs in people with no history of the condition in their family. Multiple genetic and environmental factors likely play a part in determining the risk of developing this condition.

Other Names for This Condition

- caudal dysgenesis syndrome
- caudal dysplasia sequence
- caudal regression sequence
- sacral agenesis
- sacral defect with anterior meningocele

Diagnosis & Management

Genetic Testing

- Genetic Testing Registry: Caudal regression syndrome
  https://www.ncbi.nlm.nih.gov/gtr/conditions/C0300948/

Other Diagnosis and Management Resources

- MedlinePlus Encyclopedia: Bladder Exstrophy Repair
  https://medlineplus.gov/ency/article/002997.htm
- MedlinePlus Encyclopedia: Clubfoot
  https://medlineplus.gov/ency/article/001228.htm
- MedlinePlus Encyclopedia: Inguinal Hernia Repair
  https://medlineplus.gov/ency/article/007406.htm
- MedlinePlus Encyclopedia: Neurogenic Bladder
  https://medlineplus.gov/ency/article/000754.htm

General Information from MedlinePlus

- Diagnostic Tests
  https://medlineplus.gov/diagnostictests.html
- Drug Therapy
  https://medlineplus.gov/drugtherapy.html
- Genetic Counseling
  https://medlineplus.gov/geneticcounseling.html
- Palliative Care
  https://medlineplus.gov/palliativecare.html
- Surgery and Rehabilitation
  https://medlineplus.gov/surgeryandrehabilitation.html

Additional Information & Resources

MedlinePlus

- Encyclopedia: Bladder Exstrophy Repair
  https://medlineplus.gov/ency/article/002997.htm
- Encyclopedia: Clubfoot
  https://medlineplus.gov/ency/article/001228.htm
- Encyclopedia: Imperforate Anus
  https://medlineplus.gov/ency/article/001147.htm
- Encyclopedia: Inguinal Hernia Repair
  https://medlineplus.gov/ency/article/007406.htm
- Encyclopedia: Neurogenic Bladder
  https://medlineplus.gov/ency/article/000754.htm
- Health Topic: Scoliosis
  https://medlineplus.gov/scoliosis.html
- Health Topic: Spinal Cord Diseases
  https://medlineplus.gov/spinalcorddiseases.html

Genetic and Rare Diseases Information Center

- Caudal regression syndrome
  https://rarediseases.info.nih.gov/diseases/6007/caudal-regression-syndrome

Educational Resources

- Boston Children's Hospital: Spine Problems
  http://www.childrenshospital.org/conditions-and-treatments/conditions/spine-problems
- Disease InfoSearch: Caudal Regression Syndrome
  http://www.diseaseinfosearch.org/Caudal+Regression+Syndrome/1174
- Disease InfoSearch: Sacral defect with anterior meningocele
  http://www.diseaseinfosearch.org/Sacral+defect+with+anterior+meningocele/6387
- KidsHealth from Nemours: Intestinal Malrotation
  http://kidshealth.org/en/parents/malrotation.html
- MalaCards: caudal regression syndrome
  http://www.malacards.org/card/caudal_regression_syndrome
- March of Dimes: Preexisting Diabetes
  http://www.marchofdimes.org/complications/preexisting-diabetes.aspx

- Merck Manual Consumer Version: Urinary Tract Defects
  http://www.merckmanuals.com/home/children-s-health-issues/birth-defects/urinary-tract-defects
- Mother To Baby: Diabetes and Pregnancy
  http://mothertobaby.org/fact-sheets/diabetes-pregnancy/
- Orphanet: Caudal regression sequence
  http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=3027

Patient Support and Advocacy Resources

- March of Dimes: Genital and Urinary Tract Defects
  http://www.marchofdimes.org/baby/genital-and-urinary-tract-defects.aspx
- National Organization for Rare Disorders (NORD)
  https://rarediseases.org/rare-diseases/caudal-regression-syndrome/

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28caudal+regression+syndrome%5BTIAB%5D%29+OR+%28caudal+dysgenesis%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D

OMIM

- SACRAL DEFECT WITH ANTERIOR MENINGOCELE
  http://omim.org/entry/600145

Sources for This Summary

- Boulas MM. Recognition of caudal regression syndrome. Adv Neonatal Care. 2009 Apr;9(2):61-9; quiz 70-1. doi: 10.1097/ANC.0b013e31819de44f. Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/19363325
- Duesterhoeft SM, Ernst LM, Siebert JR, Kapur RP. Five cases of caudal regression with an aberrant abdominal umbilical artery: Further support for a caudal regression-sirenomelia spectrum. Am J Med Genet A. 2007 Dec 15;143A(24):3175-84.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17963219
- Hentschel J, Stierkorb E, Schneider G, Goedde S, Siemer S, Gortner L. Caudal regression sequence: vascular origin? J Perinatol. 2006 Jul;26(7):445-7.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16801960
- Jeelani Y, Mosich GM, McComb JG. Closed neural tube defects in children with caudal regression. Childs Nerv Syst. 2013 Sep;29(9):1451-7. doi: 10.1007/s00381-013-2119-3. Epub 2013 Sep 7.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/24013318

- Thottungal AD, Charles AK, Dickinson JE, Bower C. Caudal dysgenesis and sirenomelia-single centre experience suggests common pathogenic basis. Am J Med Genet A. 2010 Oct;152A(10): 2578-87. doi: 10.1002/ajmg.a.33599.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20734338
- Torre M, Buffa P, Jasonni V, Cama A. Long-term urologic outcome in patients with caudal regression syndrome, compared with meningomyelocele and spinal cord lipoma. J Pediatr Surg. 2008 Mar;43(3):530-3. doi: 10.1016/j.jpedsurg.2007.10.036.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18358295

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